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**A word from the Editor ...**

Greetings to you our dear readers.

Welcome to the 8th edition of our external newsletter, Agring Bulletin. We trust you will find the contents useful since this edition includes some additional information on previous articles for which many inquiries were received. We are also proud to announce the new edition of the Irrigation Design and Irrigation User Manuals.

We take this opportunity to thank you for reading our newsletter. We will keep on striving to publish articles with information that you will always find helpful.

Best regards
Dr Macdex Mutema

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**ARC-NRE staff participate in clean combustion technology in modern rural areas for developing countries course in China**
– by Mr Khutsang Erence Manyako

Mr Khutsang Erence Manyako and Ms Primrose Magama from the ARC-NRE Silverton campus were among the 73 participants from developing countries who participated in the clean combustion technology in modern rural areas for developing countries course held in Changsha City, Hunan Province, China from 20 October to 9 November 2021. Eleven developing countries were represented: South Africa, Egypt, Kenya, Mozambique, Mauritius, Nigeria, Pakistan, Sri Lanka, Venezuela, Zambia and Zimbabwe. The course was offered by Yuan Longping High-tech Agriculture Co. Ltd, which is an international seed company named after the academician Yuan Longping, the “Father of Hybrid Rice” and the honorary chairman of the company. The course covered an introduction to Chinese national conditions and culture; successful experience on COVID-19 epidemic prevention and control; an overview of renewable energy in Chinese rural areas and Chinese renewable energy support policy; and an introduction to the advanced technology and construction level of Chinese clean combustion technology to facilitate the promotion and application of clean combustion technology in modern rural areas for developing countries to accelerate agricultural development in the rural areas.

Mr Manyako was requested by the Longping High-tech Agriculture Co. Ltd organizers to give a welcoming speech to all the participants.

It can be concluded that the training was educative and impactful. Although China is a developing country, it is far ahead of many other developing countries in terms of renewable energy technological advancement. What stood out amongst other issues is China’s intensified support toward decentralized energy production systems; for example, biogas utilization by rural families and small-scale farmers has become more common. However, there was consensus amongst the course attendees that more could still be done at household level and small-scale farmer level to accelerate agricultural development.

Nevertheless, it was equally appreciated that a country like China with already advanced small-scale clean energy technologies (biogas stove, biogas engines, etc.) could form good co-operations with other developing countries through the sharing of knowledge, technology and experiences in all spheres of professions, for the benefit of rural communities.

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Quantifying irrigation water losses is important for improved water use – by Dr Macdex Mutema

It is common knowledge that agriculture consumes the bulk of water used in countries that strongly depend on agriculture for food, jobs and poverty reduction. Most of this water goes into irrigated crop production. Unfortunately, irrigation systems waste a lot of water. In South Africa, they are estimated to waste around 43% of the water supplied. It is now mandatory in this country that irrigation systems report on water usage and losses. Irrigation water losses occur at different levels of the irrigation systems, but there is growing interest in losses that occur during conveyance and at the field level.

Conveyance water losses are those losses that occur when the water is in transit from sources (e.g. dams and rivers) to the intended destinations (i.e. farms, where the water is used to irrigate crops). A significant number of big irrigation schemes in South Africa use canals to move water from the sources to the farms. Water is lost along the canals through seepage, leakage, evaporation and other means. Most canals at the irrigation schemes are in a deteriorated condition due to inter alia old age and poor maintenance, exacerbating the water losses.

While most South African irrigation scheme canals are acknowledged to be aged and probably losing a lot of water, there is no initiative tracking these losses continuously. The Water Administration System (www.wateradmin.co.za) that reports water losses from SA irrigation systems only records the total losses, i.e. lumping together transit losses and those at the farm level. That makes it difficult to allocate the canal share of the losses, which only succeeds in keeping the water managers at the irrigation schemes relaxed because any losses observed can easily be passed on to the water users. Unfortunately, with that relaxation also comes a lack of knowledge on priority canal components to target for upgrading and/or maintenance. The current practice is to target dilapidated sections for repairs.

Information on canal water losses is not only important to water managers, but also to farmers and other water users who pay for the water losses, either directly or indirectly. ARC-NRE is implementing a project at Vaalharts and Loskop irrigation schemes funded by the Water Research Commission. The project aims to develop a framework for reporting water losses from irrigation scheme canals. As already alluded to, data on water losses from canals is not readily available, which stifles the process of developing the framework.

Therefore, ARC-NRE is engaged in an ongoing campaign to perform manual flow measurements from the canals with a view to generating information that will shed some light on the quantitative water losses from the different canal levels at the irrigation schemes. A water balance approach will be adopted in determining the water losses.

Manual measurement of water flow in the canals using hand-held flow meters faces some major challenges. The first hurdle is to find a way of dealing with the strong water flows occurring at some points in the canals. Flow depths can be greater than 2 m in the main canals, where flow velocities can exceed 2 m/s which creates a very strong force on the measuring equipment.

Figure 1: Photos illustrating the condition of some sections of the canals at Vaalharts and Loskop irrigation schemes. Sections showing deteriorated conditions were found across all canal levels, i.e. main, secondary and tertiary canals.
Training in water-saving irrigation technologies article continued from previous page ...

Quantifying irrigation water losses article continued from previous page ...

**Figure 2**: Photos showing an improvised support system to the flow meter pole (left) and the broken wooden support (right). The breakage was caused by the strong water flow in the main canal at Vaalharts irrigation scheme. The flow depth was greater than 2 m and the flow velocity was almost 2 m/s.

Even the shallower canals, especially the secondary canals, also exhibit strong flow rates at some canal locations. In addition to damaging the measuring equipment, this also makes it difficult to hold the flow meters in stable positions.

**Figure 3**: A member of the research team using a short wooden pole to assess the depth of a secondary canal where the flow rate exceeded 3 m/s.

**Figure 4**: A member of the research team unscrewing the propeller of the flow meter in order to remove algae that stopped it from rotating.

Another nagging problem is the high level of algae in the canals across all levels, i.e. main, secondary and tertiary canals. In addition to affecting the water flow, especially in the smaller canals, the algae also frequently clog the flow meter propeller, thereby hindering the measurements. Therefore, considerable time is spent cleaning the propeller to ensure free rotation. Too frequent unscrewing and re-screwing of the propeller might compromise the lifespan of the machine.

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The other important challenge relates to quantification of the illegal use of water, which might constitute significant losses especially along the main canals. Figure 5 shows some of the illegal water use scenarios prevalent in the irrigation schemes.

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Figure 5: Photos showing young boys and girls from communities located along the main canals coming to swim in them (top left) and fetching water from them when they are done playing (top right). Also shown are cattle that come to drink from the canals (bottom left) and serious water poaching (bottom right).
Laboratory network for essential oils testing flagship project

by Dr Idan Chiyanzu

Three South African laboratories, namely the ARC, National Metrology Institute of South Africa (NMISA) and University of Limpopo (UL), will work with the United Nations Industrial Development Organization (UNIDO), Global Quality and Standards Programme (GQSP) and Southern African Essential Oil Producers' Association (SAEOPA) to strengthen the quality system aiming to support sustainable integration of SMEs into global markets. The GQSP foresees the development of these three essential oil testing labs over a 3-year period. The aim of the project is to strengthen the labs with equipment for certifying essential and vegetable oil products for export from South Africa.

The donation of a polarimeter is part of a UNIDO project supporting the transition from conventional marketing of essential oils to more quality and sustainable alternatives in South Africa. The project is funded by the United Nations Development Programme (UNDP). One of the outputs is specifically designed to support and migrate more SMEs and emerging essential oils producers from local markets into the global value-chain by ensuring that the role of product certification is formally recognized and valued, and that they are integrated into the export initiatives of the Department of Trade, Industry and Competition (DTIC).

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Polarimeter at ARC NRE (Silverton campus) and training held on 23 and 30 May 2022.

Introducing the new edition of the Irrigation Design and Irrigation User Manuals !!!

NEWLY revised Irrigation Design Manual and Irrigation User Manual now available

The ARC-Natural Resources and Engineering division, supported by the Water Research Commission, is proud to announce that the new edition of the Irrigation Design Manual, as well as the Irrigation User manual, is now available in PDF format and on CD.

The Irrigation Design Manual consisting of 20 chapters contains valuable updated information for the design of irrigation systems and the User Manual consisting of 16 chapters contains information on the erection, installation, and maintenance of irrigation systems.

• To order kindly contact Elmarie Stoltz at stoltze@arc.agric.za
• For technical or general inquiries about the manuals kindly contact the project leader Dr. Khumbulani Dlalu at dhavuk@arc.agric.za

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Guidelines for measuring flow in pipes
– by Mr Fanie Vorster

In order to efficiently manage any process where a fluid is involved, the flow has to be measured accurately.

Efficient management of any fluid process requires accurate measurement of the flow. Several devices are available for measuring flow in pipes. Each device has certain advantages, but also limitations. In this article we are not going to cover the different types of flow meters with their unique characteristics, but only one often overlooked aspect that influences the accuracy of flow measurements irrespective of the type of flow meter used. The installation location of a flow meter in or on a pipe system has a big influence on the accuracy of the measurements. The presence of turbulence in the pipe section where the flow meter is installed affects the accuracy of the readings. Turbulence is typically present downstream of pumps, near valves, bends, reducers, T-pieces and any other type of fitting, as well as in downward sloping pipe sections. There are internationally accepted standards that specify the most appropriate distances that a flow meter should be installed from the different elements mentioned above. The following general installation requirements are applicable:

- To ensure that the flow meter operates as intended, it should be installed in the position and orientation as recommended by the manufacturer.
- In case of poor water quality, an appropriate filter should be installed upstream of the flow meter, to protect it from blockage. The filters must be installed in such a way that they are easily accessible for maintenance and cleaning, and do not impair the operation of the flow meter.
- Ensure that the materials used for the installation are of good quality.
- The installation site should be easily accessible.
- Provide sufficient space around the installation to enable easy maintenance, calibration or removal of the device, if necessary.
- Provide a concrete slab around the area to prevent the growth of vegetation and provide protection for the device from veld fires.
- If necessary and possible, install permanent connection points for in-field calibration or verification. This may include pressure measuring points, inspection inlets or positioning guides for current meters.
- When the device is installed in a critical section of the pipeline, a bypass pipe should be provided. Thereby the device can be removed for repairs without interrupting the flow.
- For a flow meter to operate correctly, the pipe it is fitted in should be completely full of water. If air or vapour is present in the pipe it can cause the measurements to be inaccurate or damage the flow meter.
- A flow meter should preferably be placed in a low horizontal or slightly rising pipe section, never in a vertical pipe section where the flow is going downwards, or in a horizontal section that is located at the highest part of the pipeline.
- If pressure fluctuations and flow surges exist in the pipeline, equipment to protect the flow meter from these should be installed.
- The flow conditions in the pipe should be as close as possible to laminar flow. To achieve this flow regime, the following installation guidelines as shown in Figure 1 are recommended:
- Install the flow meter in a pipe section where upstream of the meter, the pipe is straight, without any fittings that can cause flow disturbances, with a constant diameter and length of at least 10x the pipe diameter. As an absolute minimum a straight length of 5x pipe diameters could be used.
- Downstream of the flow meter, there should be a straight pipe section of constant diameter with a length of 5x the pipe diameter. There should be no fittings that could cause flow disturbances. As an absolute minimum a straight length of 3x pipe diameters could be used.
- In case it is not possible to achieve stable/laminar flow conditions by means of the above installation guidelines, another option is to use flow conditioning devices such as straighteners or vanes inside the pipe. Due to irrigation water containing impurities that can cause blockages at the vanes, this method is not recommended in irrigation water supply pipes.

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The Agricultural Mechanization, Agro-Processing & Renewable Energy unit of ARC-NRE will publish the following new publication on 1 July 2022:

“Processing of Confectionary Products”
authored by Ms Theresa Siebert

Summary of the publication:
The term “confectionary” can be defined as the “art of making confections”. “Confections” in turn are defined as food products that are rich in sugar and carbohydrates. Confectionary can be divided into two broad and somewhat overlapping categories, namely Bakers’ Confectionary and Sugar Confectionary. This publication is aimed more at providing information on the products which may be used in the art of creating confectionary, rather than focusing only on the confectionaries themselves.

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For enquiries on purchasing this manual, kindly contact Ms Elmarie Stoltz: stoltze@arc.agric.za